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BOOK REVIEWS

GEOMORPHIC SYSTEMS edited by J. D. Phillips and W. H. Renwick, Elsevier, Amsterdam, 1992. (Reprinted from *Geomorphology*, **5**(3–5), 195–489.) Price: Dfl. 270·00. ISBN 0-444-89809-3.

The Binghamton Symposia started by Donald Coates and Marie Morisawa deserve renewed salute as a long-sustained enterprise in geomorphological publishing. The 23rd had 'geomorphic systems' as its subject. The year of this meeting was an anniversary of both A. N. Strahler's 1952 paper on the dynamic basis of geomorphology, and R. J. Chorley's 1962 paper on geomorphology and general systems theory. A more diffuse reason identified by the senior editor for focusing on systems is the great body of recent theoretical and applied research in mathematics and natural science on dynamical systems, including non-linearity and chaos. A few papers in the collection look backwards, with a serious discussion of the history of ideas, several draw inspiration from that recent body of work, and not a few pay little or no attention to any but the most diluted sense of geomorphological systems. The book does not transcend the usual limitations of a conference volume in adding up to less than the sum of its parts, but perhaps only some editors and reviewers worry about the coherence of such collections. Readers can treat them just like issues of scientific journals and ignore all but the few items of personal interest (note well that this is also an issue of a journal).

There are two primarily historical papers. In a thoughtful and characteristically non-linear piece, Barbara Kennedy looks afresh at Hutton, Lyell, Darwin, Dana, Gilbert and Horton, and reflects on the different roles of equilibrium and change in their ideas. Her contrasts cast doubt on many of the cartoon histories passed down within the discipline and may encourage a reading of some of the classic works. Dorothy Sack also takes a revisionist view of the ways in which Strahler, Hack and Chorley used (and misused) history in arguing for a dynamic geomorphology that was supposedly both path-breaking and faithful to a fine Gilbertian tradition. Her paper is clear and useful, but marred by the stale and unnecessary terminology of 'paradigm change'.

Of the remaining papers, I enjoyed best those focusing on particular problems, especially those blending interesting models and field data (or at least realistic simulated data). James Pizzuto gives a pleasingly self-critical report on a model for downstream hydraulic geometry tested against literature and field data from Pennsylvania and nearby, culminating in a very stimulating discussion of appropriate time scales. Phillip Bonneau and Scott Snow have well-designed simulations of headwaters adjustment to base-level drop for alluvial streams, while Francis Magilligan focuses on the variability of stream power during extreme floods. Adrian Harvey continues his project monitoring gullies in the Howgill Fells of Northern England, with some worthwhile examples of the tension between gully extension and vegetation stabilization. Ede Ijjasz-Vasquez and colleagues write on the multifractal characterization of river basins, while Andrew Simon jumps from observing that properties such as specific energy decline after catastrophic disturbance of fluvial systems to inferring that they are being minimized. Bruce Rhoads is knowledgeably neurotic, econometrics-style, about error structures and estimation procedures for statistical models, but keeps the data at sufficient length from the reader to inhibit independent conclusions.

The overwhelmingly fluvial bias of the volume is offset slightly by Douglas Sherman on aeolian saltation, examining the relationship between shear velocity and apparent roughness length, and by Peter Patton and Gregory Horne on the response of the Connecticut River estuary to late Holocene sea-level rise. The latter operate within a chronological framework provided by datable deposits, in marked contrast to most of the other papers in the symposium.

The remaining papers are, unfortunately, disappointing in my judgement. They mainly restate well-worn principles in fashionable or idiosyncratic form, or recycle much of the verbiage from previous literature (mostly to do with the highly confused concept of equilibrium), or speculate loosely and uncritically on the basis of limited analysis of the authors' own models. Usually the latter are introduced too briefly and cryptically to allow full appreciation of what was done and why we should take it seriously. The standard of clarity, cogency and competence is often low and a few papers are likely to be obscure even to the well-informed. One author contrives to mangle the simple idea that change in storage equals input minus output, by recasting it in a dimensionally and notationally inconsistent equation. This is not to deny that some notable ideas and results are scattered throughout, but I would not recommend the papers in question to people in a busy world. Names are spared to protect the guilty.

Chaos and related phenonena are fascinating and vital topics that all geomorphologists should know a little about, even if only a smattering picked up from popular accounts. However, it is crucial to grasp that there is a lot of solid mathematics and science beyond the hype, a basic point flouted in this symposium either by those who use a term like 'chaos' as if it means merely irregularity or unpredictability, ignoring its precise connotations, or by those who postulate chaotic behaviour on the flimsiest of grounds. A deeper principle often ignored is the contrast between difference and ordinary differential equations on the one hand and partial

differential equations on the other. As I understand it, the great bulk of rigorous work on chaos focuses on the former, whereas much modelling in geomorphology is of spatial (distributed) systems varying over time, leading frequently to analysis in terms of the latter. It is by no means automatic that behaviour in each case is an exact analogue of the other. For some papers in this book, this and other technical points amount to minor issues of presentation, because the formalism is employed in a largely ceremonial or ornamental manner: the equations are quoted (or misquoted), but little used, and they serve chiefly as decoration to a largely verbal treatment, an unsatisfactory mishmash of buzzwords and banalities.

A great curse of geomorphology is this: incoherent degradation of theory is often more prominent than coherent theory of degradation. In this volume, as in the geomorphological literature as a whole, the discerning reader must tread carefully to avoid the morasses of bombast and rehash, and reach the firm dry land of lucid review or original contribution.

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TURBULENCE: PERSPECTIVES ON FLOW AND SEDIMENT TRANSPORT edited by N. J. Clifford, J. R. French and J. Hardisty, John Wiley & Sons, Chichester, 1993. No. of pages: xv + 360. Price: £45·00. ISBN 0-471-93900-5.

The editors of this handsomely produced book are to be commended for their timely contribution to the literature on geophysical turbulent flow and sediment transport. The dissemination of fast response sensors has led to rapid growth of research in this sphere and a review of the main substantive and methodological issues is useful at this moment. A few familiar but central questions recur in this collection of 14 papers, such as:

— to what extent are concepts developed in the laboratory, such as turbulent bursting, applicable to the structure of high Reynolds number flows over complex geophysical boundaries?
— what elements of the turbulence structure control sediment transport and bed deformation?

Although a few papers include theoretical sections, the main emphasis of the book is on flow observation rather than modelling. The first five papers discuss relevant methodology (sensor characteristics and mathematical techniques) and briefly review our current 'visualization' of turbulent flows over deformable sediment boundaries. These introductory papers are followed by two papers presenting results on boundary layers over gravel beds, one on confluent mixing, one on flow over bedforms, two on tidal flows and three on aeolian boundary layers.

It is impossible to comment on all papers here. In my opinion, a slightly greater emphasis on reviewing methodological problems and substantive debates would have been useful. The treatment of basic analytical considerations is cursory in the introductory chapters. For example, the effects of sensor time response (due to size as well as electronics) and of sampling rate on signal spectra and measured variances or covariances are only briefly alluded to, and the effects of non-turbulent low-frequency content on integral scales is not emphasized. Much confusion can result when such effects are not properly addressed in research design, and new students of the field will still need to go to the basic mathematical and geophysical literature for guidance. To be fair, a full exposition of these problems would have reduced the space provided for original results.

More seriously, a number of flaws have crept into the book: equations 1.22, 1.23 and 1.30, among others, are wrong or misinterpreted, while the notation in equations 5.3–5.8 is confusing, to say the least. Generally, spectra are presented with no information on the precise form of the power ordinate or on its units, which severely hinders comparisons. In two papers, an inappropriate use is made of the spectral gain function. For example, two completely uncorrelated white noises can be considered to be related with gain 1, according to equation 12.14; Bendat and Piersol (1986, Ch. 6) present a more realistic approach.

The review paper on turbulent structure and sediment transport by Best is thoughtful and interesting. Such critical reviews are extremely useful in this complex field. It is unfortunate that fuller reviews have not also been included on the body of work on turbulence perturbations and eddy shedding above bedforms or large roughness elements, issues which regularly play a key role in interpretations of field data. Too often in this sphere, one person's 'eddy shedding' is another person's 'macroturbulence'; clearer working definitions of turbulent flow mechanisms, descriptive as well as genetic, are required for progress.

Despite these production flaws, this book should be of interest as a review of current techniques and results.

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REFERENCES

Bendat, J. S. and Piersol, A. G. 1986. *Random Data: Analysis and Measurement Procedures*. 2nd edn, John Wiley & Sons, New York, 566 pp.